User Manual GALILEO

Communication Beckhoff TCP/IP

Software

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1. General

1.1 Aim and purpose of this document

This documentation describes the connection of a MICRO PANEL with the ADS/AMS protocol via TCP/IP to a Beckhoff PLC.

Two communication drivers are available:

- «Beckhoff – TwinCAT TCP/IP» Beckhoff PLC for symbolic programming
- «Beckhoff – BC9000 TCP/IP» Beckhoff bus coupler with Ethernet (BC9000)

☞ Refer to the Operating Instructions of your MICRO PANEL for further information on connecting, commissioning and operating the MICRO PANEL.

It is assumed that the following software is already installed and that you are familiar with its operation:

- PLC programming software TwinCAT
- HMI visualization software GALILEO

Refer to the GALILEO documentation or the Online Help for further information on GALILEO and GRS (GALILEO Runtime System).

☞
- The dialogs shown from GALILEO are from Version 5.3.5.
- The dialogs shown from TwinCAT are from Version 2.8.

2. Overview

This documentation describes the following communication option:

- Beckhoff TwinCAT – TCP/IP
  for MICRO PANELs using the Ethernet interface.
- Beckhoff TwinCAT – TCP/IP
  for GALILEO OPEN using a Windows 2000/XP target system.
- Beckhoff BC9000 – TCP/IP
  for MICRO PANELs using the Ethernet interface.

☞
- The communication supports only the first runtime with AMS-Port 801.
- «Beckhoff – BC9000 TCP/IP» or ModbusTCP can also be used for bus controllers such as BC9000.

2.1 MICRO PANEL in the network

The connection to the Beckhoff PLC is implemented directly on the Ethernet port of the CPU. Communication is implemented via TCP/IP, Port 48898 (0xBF02). The basic communication procedure is described in the Beckhoff documentation for TwinCAT ADS under «Introduction ADS».

☞ The IP addresses and AmsNetId are shown as examples! It is important that each device is assigned a unique IP address and AmsNetId. The AmsNetIds of the MICRO PANELs are the same as the respective IP address with the suffix .1.1.
The AmsNetId can be set with Beckhoff devices.

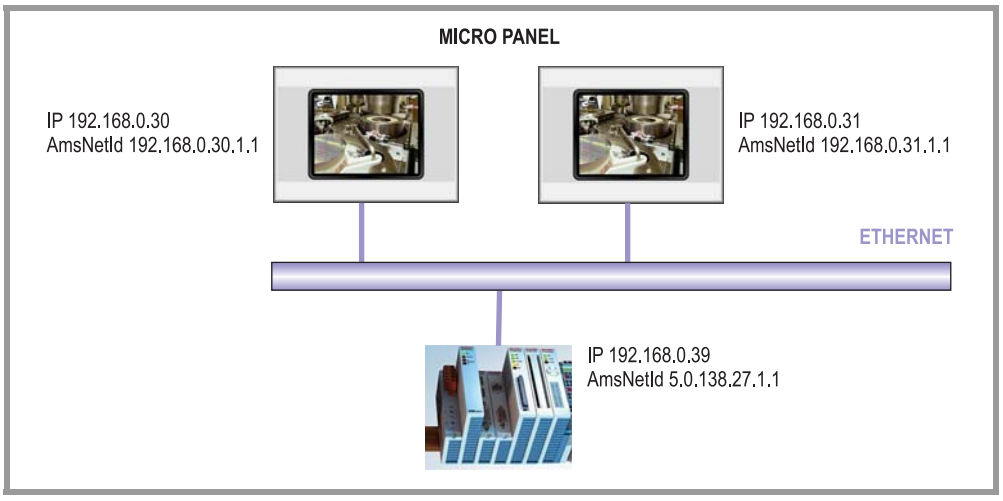

Fig. 1 MICRO PANELs – Beckhoff PLC communication

2.2 Addressing

2.2.1 Symbolic addressing

The addressing is implemented using the CoDeSys syntax. The following typical addressing types are supported:

- <tag>
- <tag>.<arrayindex>[]
- <struct>.<tag>
- <struct>.<tag>.<arrayindex>[]
- <prog>.<tag>
- <prog>.<tag>.<arrayindex>[]
- <prog>.<struct>.<tag>
- <prog>.<struct>.<tag>.<arrayindex>[]

The tag variables are addressed in GALILEO and in the PLC via the symbolic names in accordance with IEC61131-3.

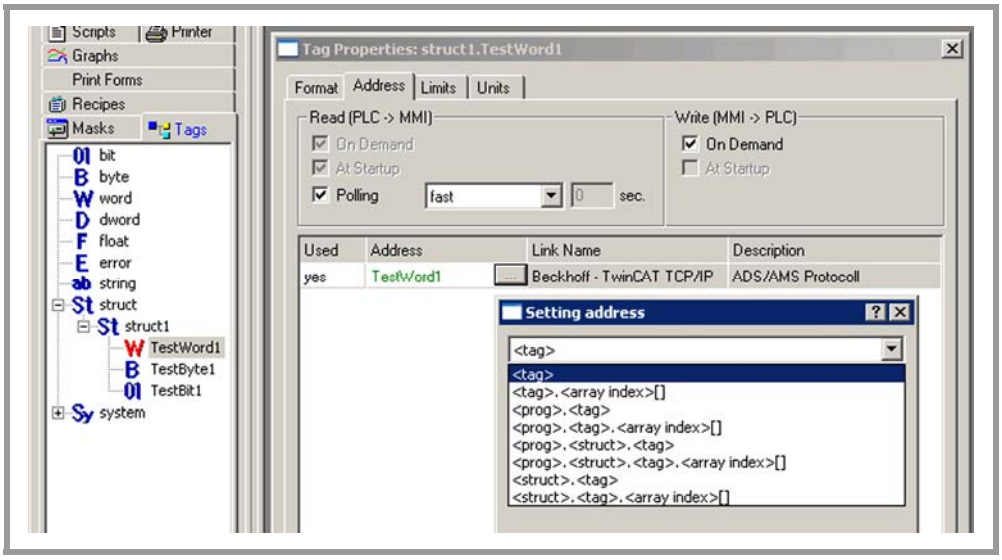

Fig. 2 Symbolic addressing

☞ The import of tag variables from the symbol file is supported. Further information is provided in the GALILEO documentation.

2.2.2 Image oriented addressing (BC9000)

A bus coupler such as BC9000 does not support symbols. Inputs, outputs and markers can however be addressed directly.

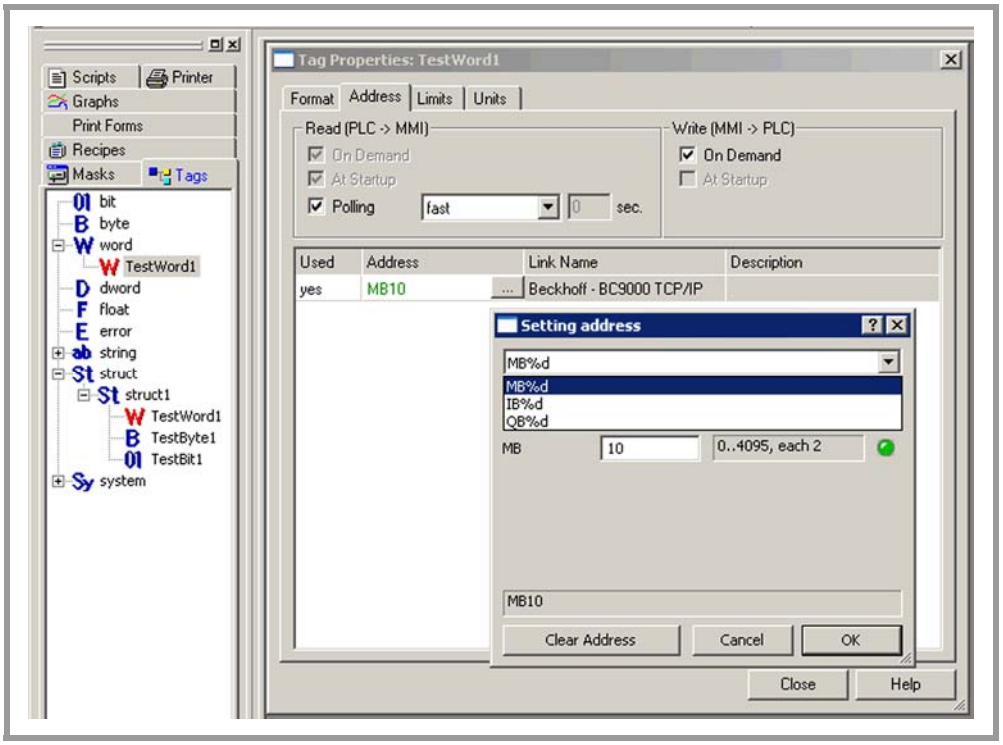

Fig. 3 Image-oriented addressing

☞ The import of tag variables has not yet been implemented.

2.3 Data block size

The smallest possible format:

- TwinCAT:
  1 bit (single bit communication is possible)
- BC9000:
  1 byte

The maximum size of a data block is 2048 bits or 256 bytes. The structure or array size set in GALILEO is therefore limited to this maximum value.

All supported data block sizes are shown on the «PLC Data» tab of the «Select PLC» dialog.

3. Implementation in GALILEO

3.1 Hardware requirements

This communication requires a MICRO PANEL with an Ethernet interface or GALILEO OPEN.

Information on the communication cable is provided in the Operating Instructions of the relevant MICRO PANEL.

3.2 Select PLC

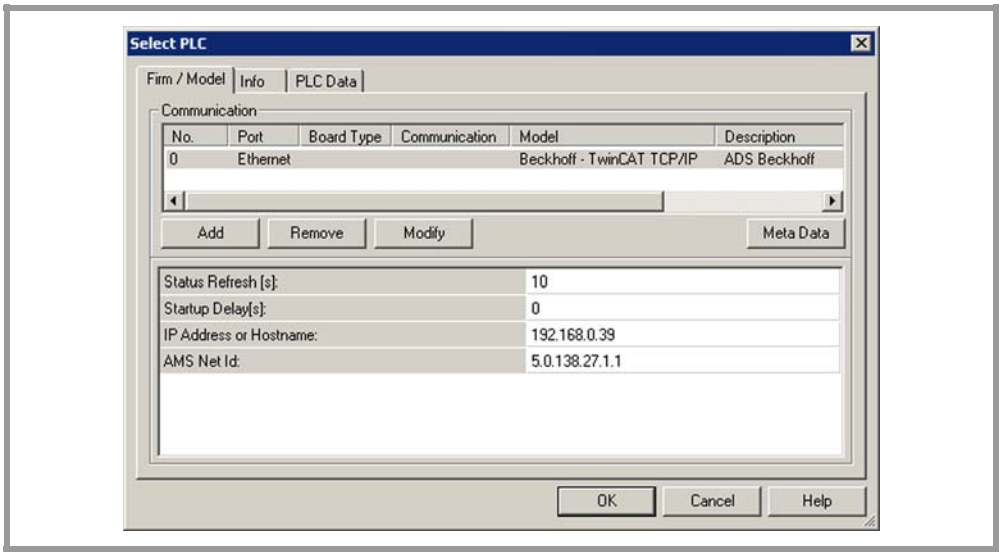

Fig. 4 Select PLC

☞ GALILEO supports multiple connections. Multiple connections can be configured to the same Ethernet interface.

1 In the «Select PLC» dialog select «Beckhoff – TwinCAT TCP/IP» or «Beckhoff BC9000 TCP/IP»
- The dialog shown appears.

2 Set here the parameters for this communication.

Parameter	Setting
Status Refresh [s]	See GALILEO Help
Startup Delay[s]	See GALILEO Help
IP Address or Hostname	IP address or network name of the Beckhoff PLC Example: 192.168.0.39

Parameter	Setting
AMS Net Id (Only for «TwinCAT TCP/IP»)	AmsNetId of the Beckhoff PLC Example: 5.0.138.27.1.1 The AmsNetId can be found in the TwinCAT System Manager under «System Configuration» on the «CX1000 Settings» tab (see Fig. 5, page 11).

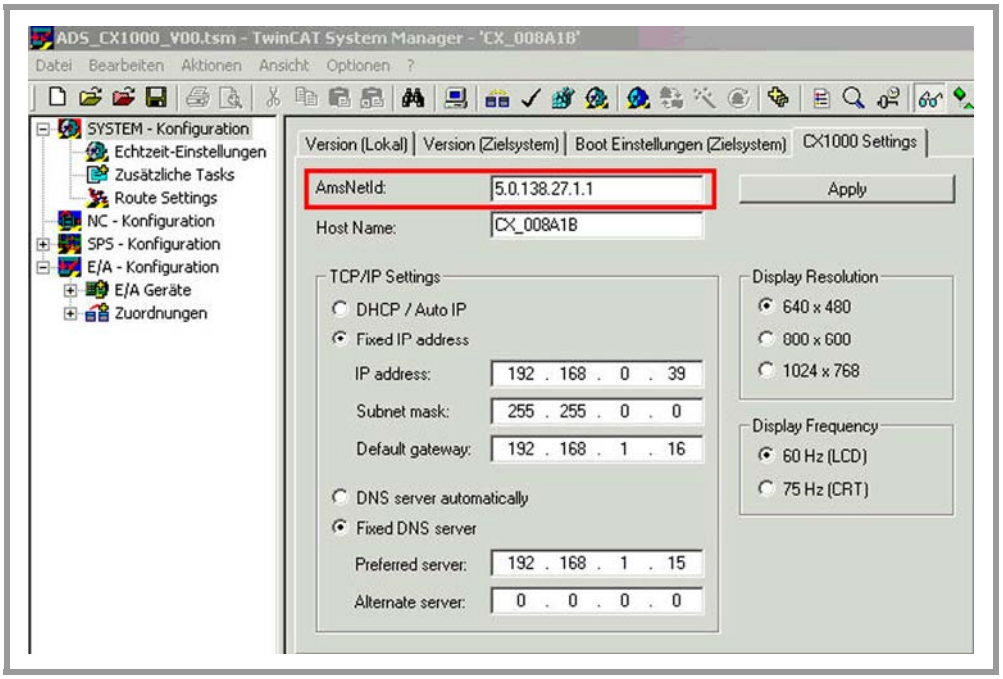

Fig. 5 AmsNetId in TwinCAT System Manager

4. Implementation in TwinCAT

☞ Chapter 4 does not apply to BC9000.

4.1 Operating principle

The exchange of objects is handled via the AMS Message Router (Automation Message Specification). This manages and distributes all messages in the system via TCP/IP connections. TwinCAT Message Routers are provided on every TwinCAT PC. The Message Router must know the AmsNetId of the GRS (GALILEO Runtime System).

☞ The AmsNetId of the GRS is the same as the respective IP address with the suffix .1.1.

4.2 Declaring the AmsNetId of the MICRO PANEL

4.2.1 In TwinCAT

1. Enter the AmsNetId and IP address of the GRS (GALILEO Runtime System) in the TwinCAT System Manager.
   - The Route Name can be assigned as required.
2. Click [Add Route].
   - The entry is transferred to the PLC.

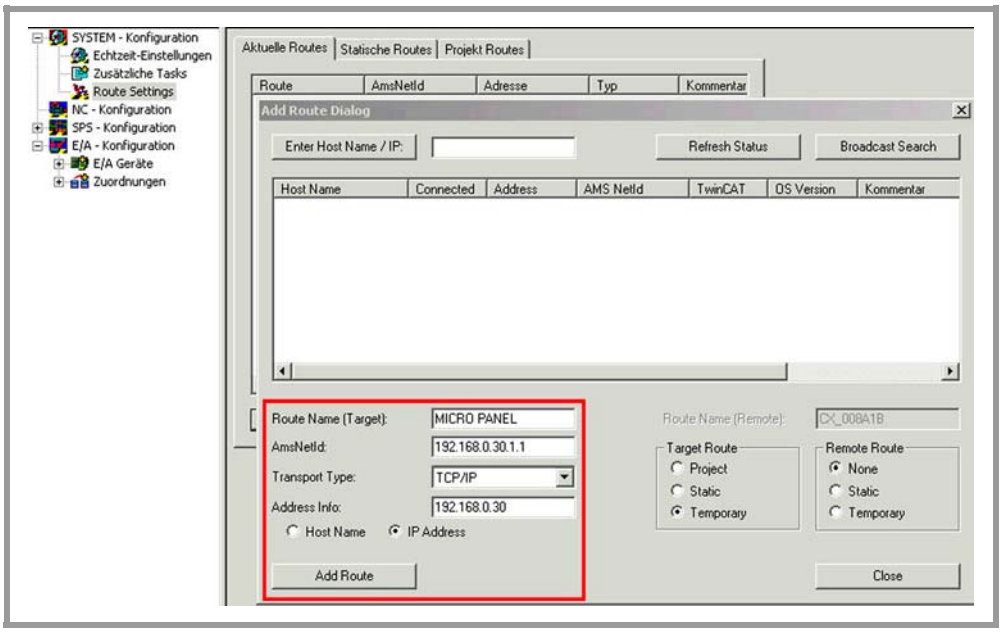

Fig. 6 Add Route dialog

4.2.2 Directly on a CX1000

Instead of declaring the panel in TwinCAT, the Message Router can also be entered directly on the PLC. This example uses CERHOST to access the panel. CERHOST is available from Beckhoff.

1. Start «TcAmsRemoteMgr.exe» in the system directory.
2. Set the parameters for the MICRO PANEL.

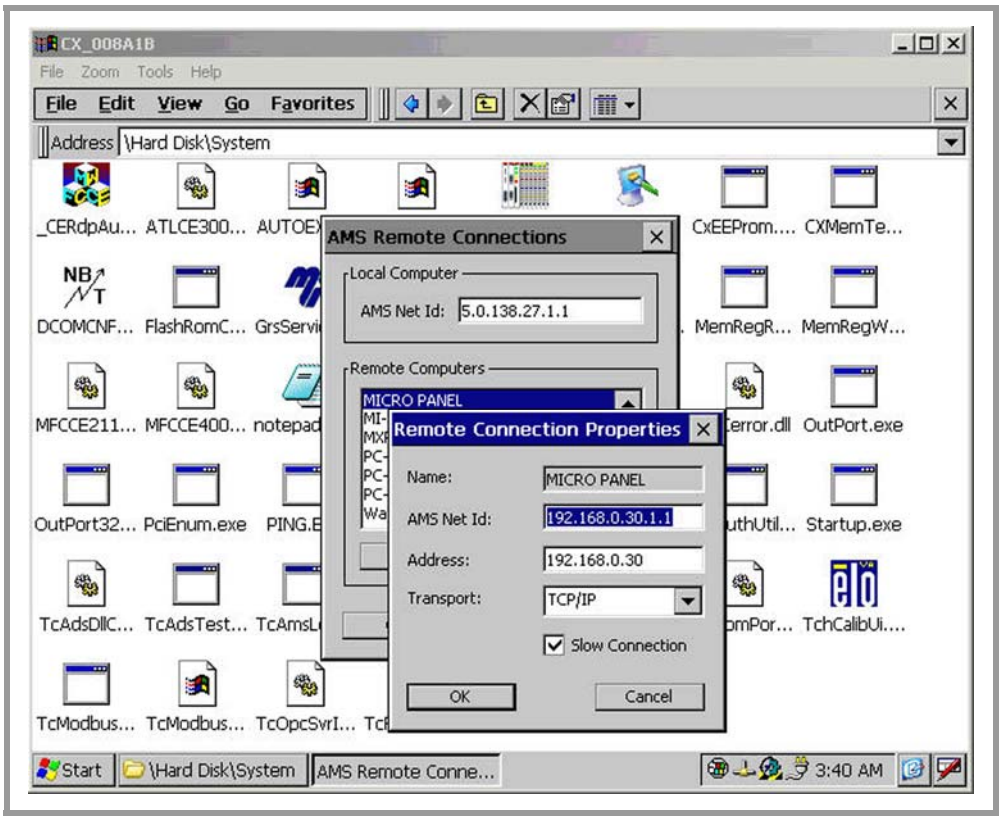

Fig. 7 Direct entry of the AMSNetId

5. GALILEO OPEN and TwinCAT

5.1 Operating principle

Beckhoff uses an AMS router on each device. This AMS router maintains a single connection with each AMS router of the other devices. GRS uses AMS and therefore communicates directly with the AMS router of the target system. On the MICRO PANEL this has the benefit that a router does not have to be installed and configured. For a PC on which the AMS router is not required, the configuration is the same as for a MICRO PANEL.

The AMS router runs on every PC that is running TwinCAT PLC or TwinCAT PLC Control. Additional configuration settings are required if GRS is used on this kind of PC. As the AMS router on the target system (TwinCAT PLC) only supports one AmsNetId per IP address, GRS must communicate with the AMS router via an additional AMS router. Depending on the configuration of the installation, use the «Microsoft Loopback Adapter» or a second IP address on a real network adapter.

5.2 TwinCAT PLC and GRS on the same PC

The use of Microsoft Loopback Adapter is recommended if GRS and TwinCAT PLC are installed on the same PLC. The Microsoft Loopback Adapter is a software that emulates a network card. Using the Microsoft Loopback Adapter means that the communication between GRS and TwinCAT PLC does not depend on the availability and function of the real network adapter or network.

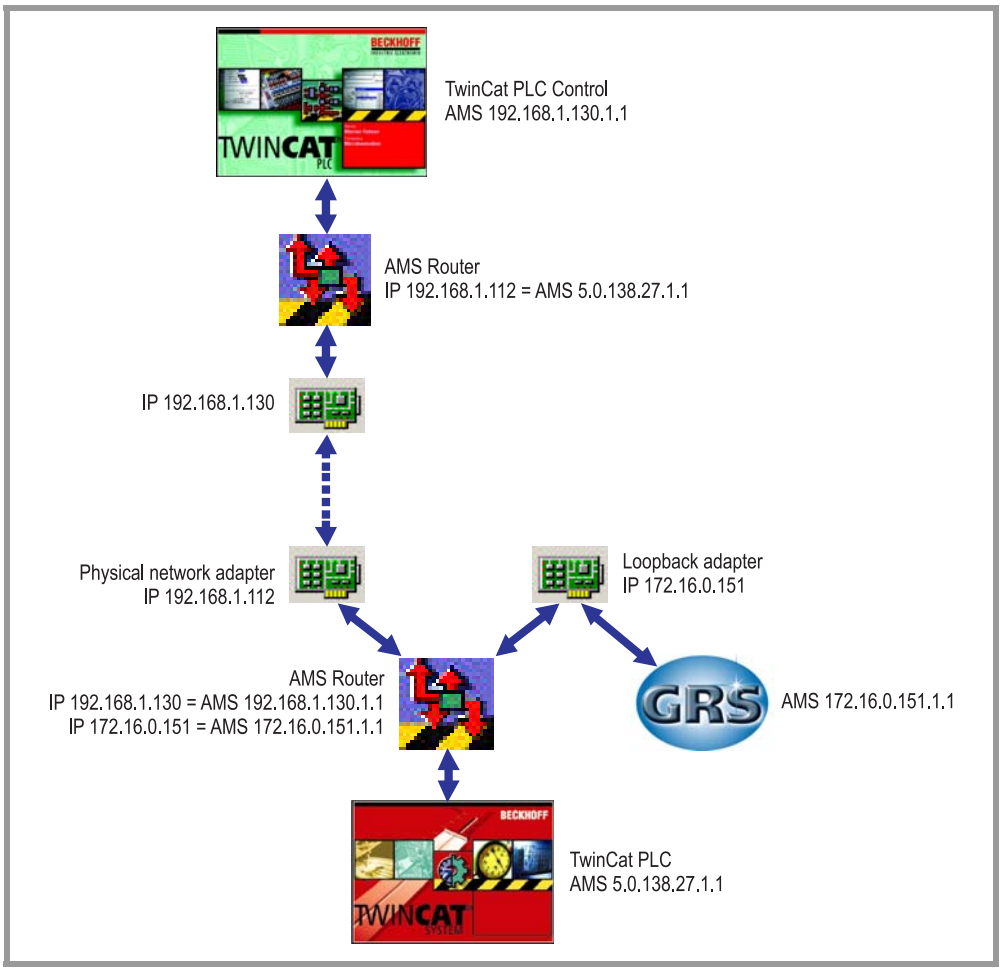

Fig. 8 Loopback adapter

5.2.1 Installation of the Microsoft Loopback adapter

1 Open the Add Hardware Wizard in the Control Panel.

2 Check «Yes, I have already connected the hardware».

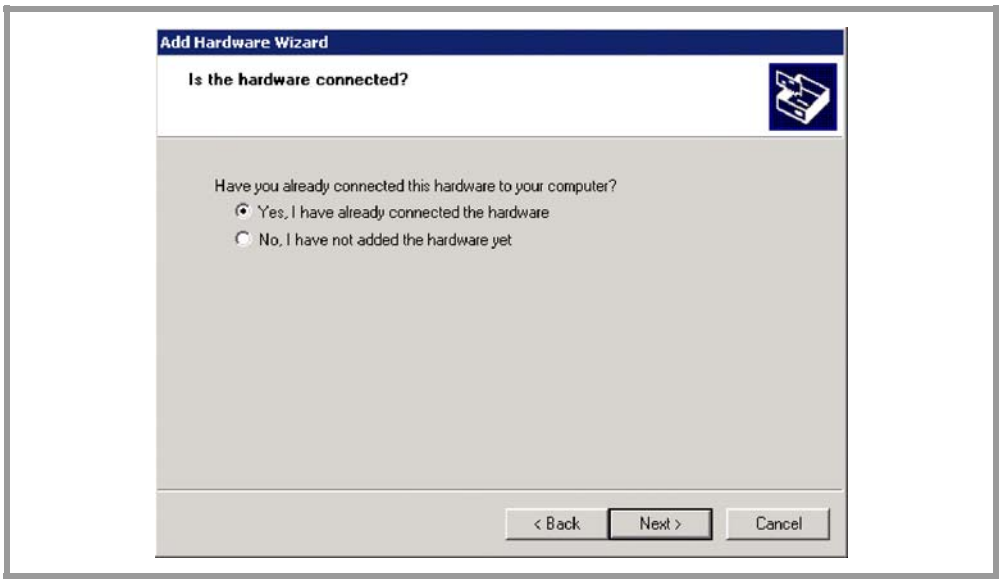
Add Hardware Wizard
Is the hardware connected?
Have you already connected this hardware to your computer?
Yes, I have already connected the hardware
No, I have not added the hardware yet
< Back
Next >
Cancel

Fig. 9 Add Hardware Wizard

3 Click [Next].

4 Select «Add a new hardware device».

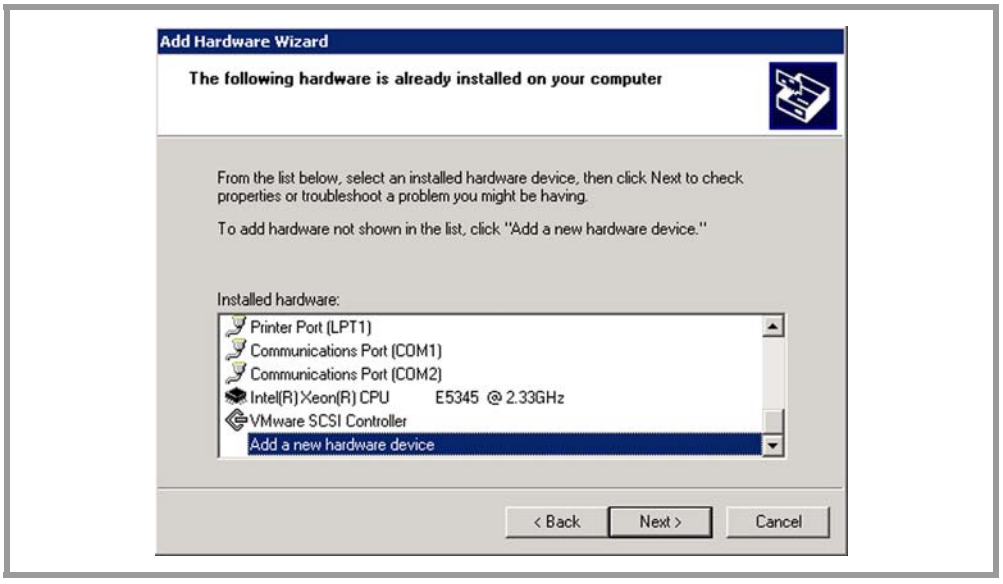
Add Hardware Wizard
The following hardware is already installed on your computer
From the list below, select an installed hardware device, then click Next to check properties or troubleshoot a problem you might be having.
To add hardware not shown in the list, click "Add a new hardware device."
Installed hardware:
Printer Port (LPT1)
Communications Port (COM1)
Communications Port (COM2)
Intel(R) Xeon(R) CPU E5345 @ 2.33GHz
VMware SCSI Controller
Add a new hardware device
< Back
Next >
Cancel

Fig. 10 Add new hardware

5 Click [Next].

6 Check «Install the hardware that I manually select from a list».

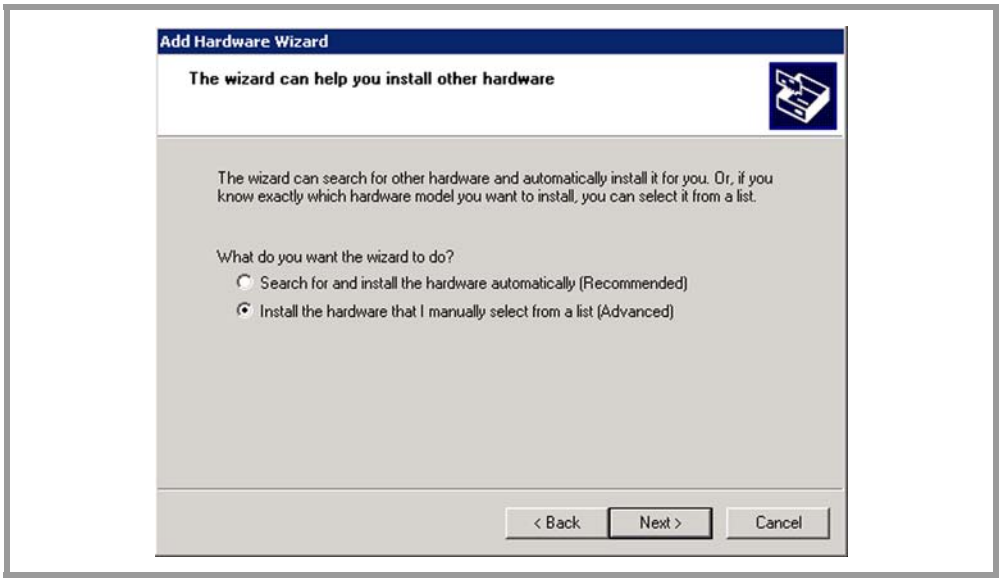
Add Hardware Wizard
The wizard can help you install other hardware
The wizard can search for other hardware and automatically install it for you. Or, if you know exactly which hardware model you want to install, you can select it from a list.
What do you want the wizard to do?
Search for and install the hardware automatically (Recommended)
Install the hardware that I manually select from a list (Advanced)
< Back
Next >
Cancel

Fig. 11 Installing hardware

7 Click [Next].

8 Check «Network adapters».

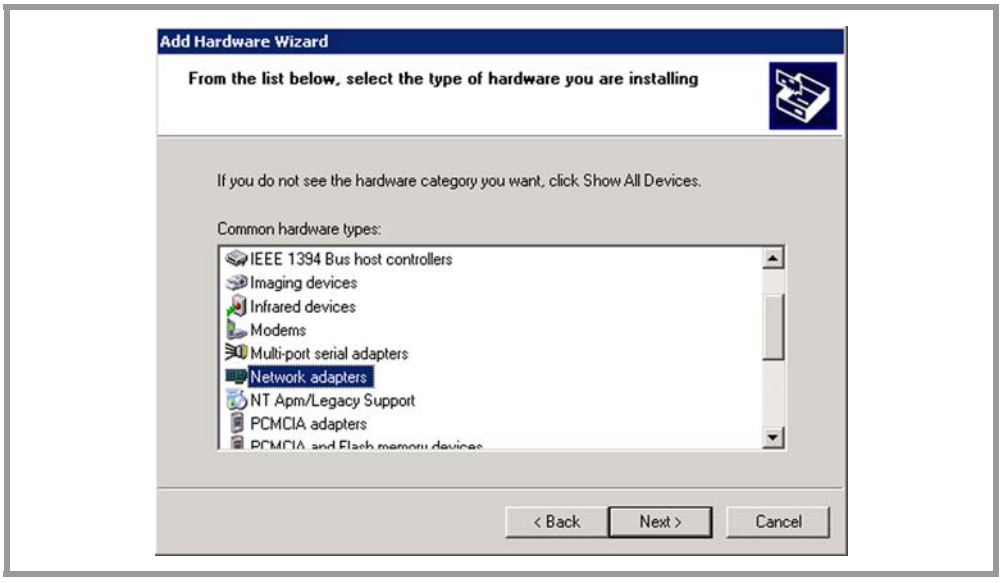
Add Hardware Wizard
From the list below, select the type of hardware you are installing
If you do not see the hardware category you want, click Show All Devices.
Common hardware types:
IEEE 1394 Bus host controllers
Imaging devices
Infrared devices
Modems
Multi-port serial adapters
Network adapters
NT Apm/Legacy Support
PCMCIA adapters
< Back
Next >
Cancel

Fig. 12 Selecting hardware type

9 Click [Next].

10 Under Manufacturer «Microsoft» and Network Adapter select «Microsoft Loopback Adapter».

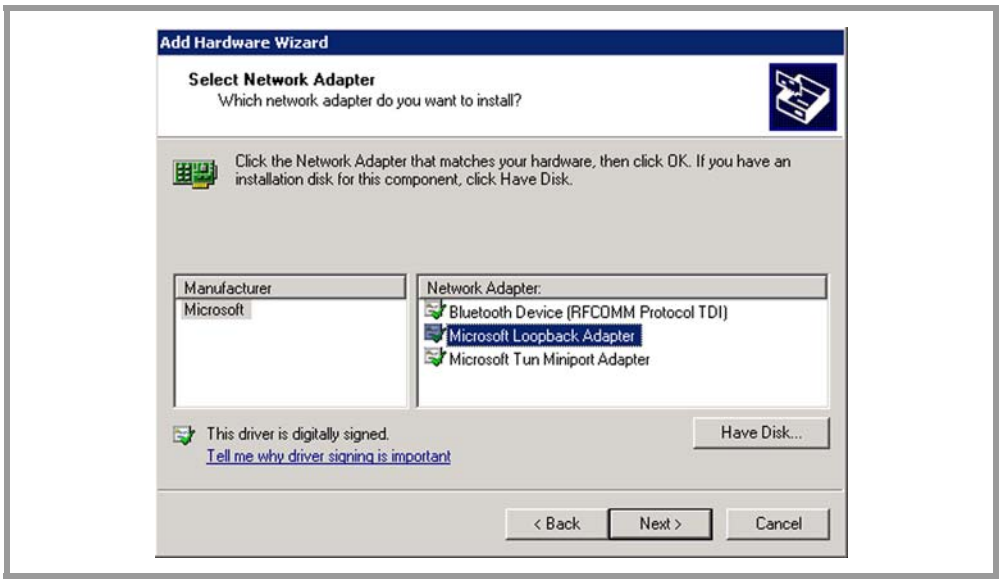
Add Hardware Wizard
Select Network Adapter
Which network adapter do you want to install?
Click the Network Adapter that matches your hardware, then click OK. If you have an installation disk for this component, click Have Disk.
Manufacturer
Microsoft
Network Adapter:
Bluetooth Device (RFCOMM Protocol TDI)
Microsoft Loopback Adapter
Microsoft Tun Miniport Adapter
This driver is digitally signed.
Tell me why driver signing is important
Have Disk...
< Back
Next >
Cancel

Fig. 13 Selecting network adapter

11 Click [Next].

- The Microsoft Loopback Adapter can now be installed.

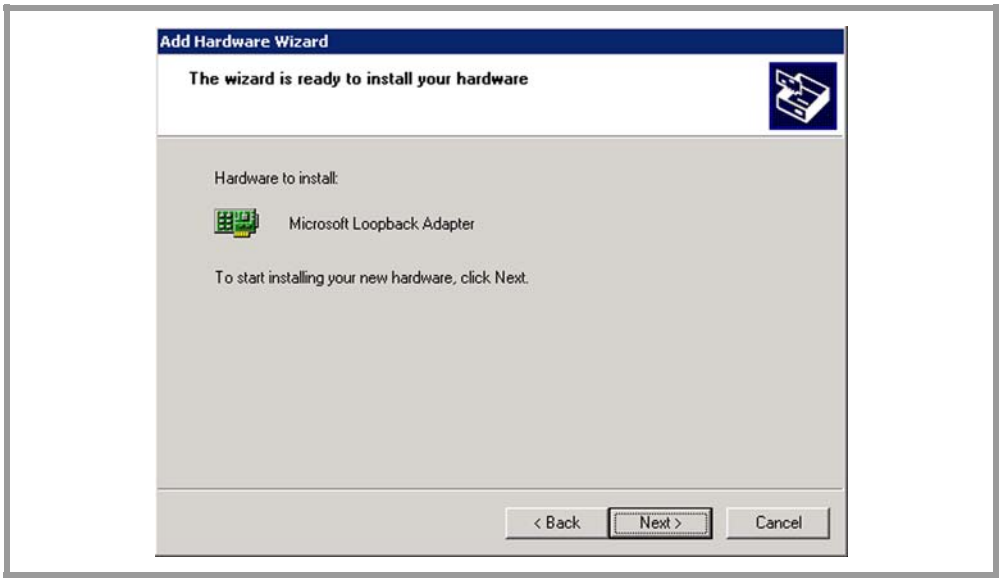
Add Hardware Wizard
The wizard is ready to install your hardware
Hardware to install:
Microsoft Loopback Adapter
To start installing your new hardware, click Next.
< Back
Next >
Cancel

Fig. 14 Installing Loopback Adapter

12 Click [Next].

- The Microsoft Loopback Adapter is installed.

5.2.2 Configuration of the Microsoft Loopback Adapter

1 Activate «Internet Protocol (TCP/IP)» only.

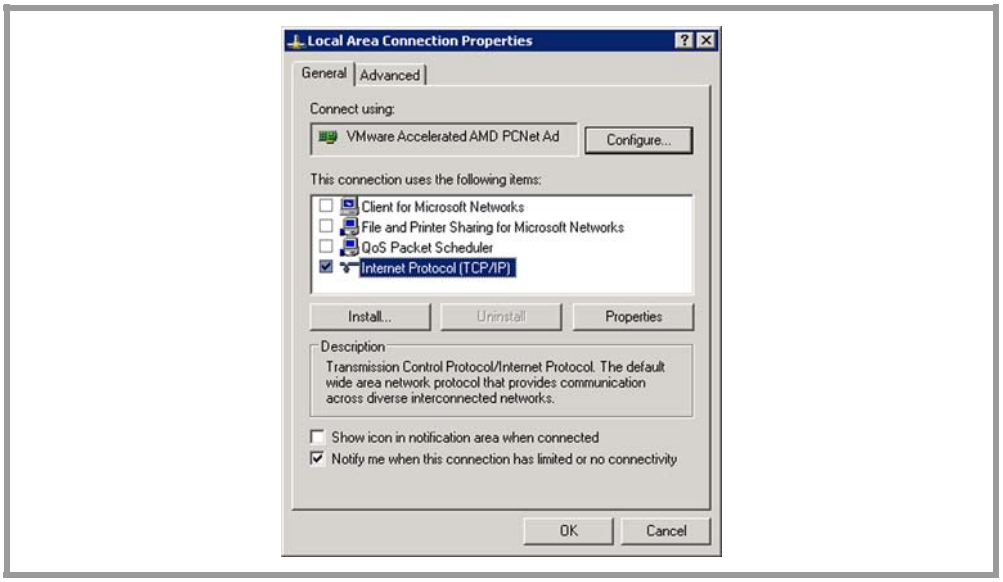

Fig. 15 Activating «Internet Protocol (TCP/IP)»

2 Click [Properties].

3 Enter an IP address from the private IP address range which is immediately always available even if a network cable is not plugged into the target system.

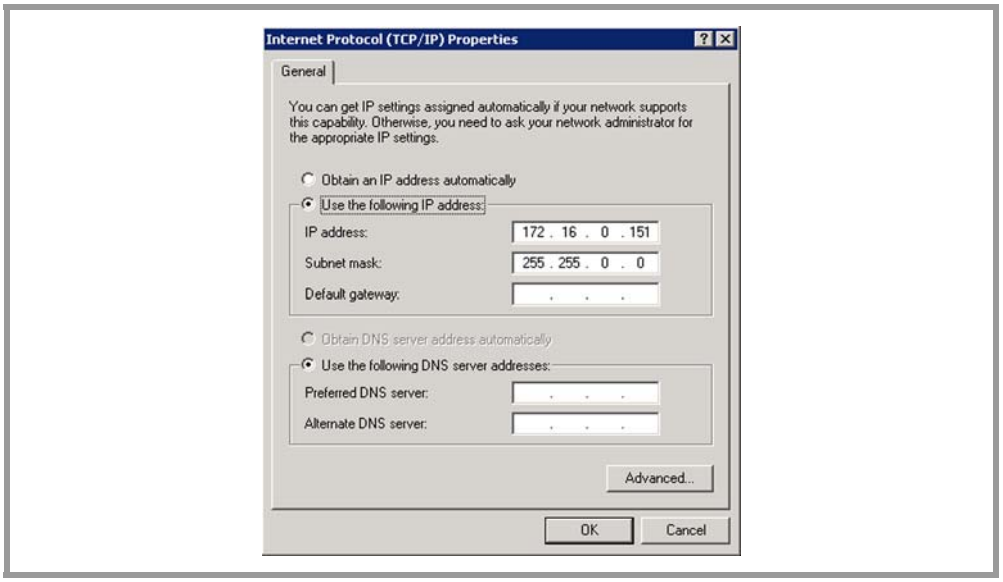
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 172 . 16 . 0 . 151
Subnet mask: 255 . 255 . 0 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Fig. 16 Entering an IP address

4 Click [OK].

5.2.3 Declaring the AmsNetId of the GRS

1 Enter the AmsNetId and the IP address in TwinCAT, as described in chapter 4.2.1.
- The IP address must match the setting in the network properties of the Loopback Adapter. In our example this is 172.16.0.151.
- The AmsNetId of the GRS is the same as the respective IP address with the suffix .1.1. In our example this is 172.16.0.151.1.1.

5.2.4 Selecting PLC in GALILEO

In GALILEO you must also set the IP address of the Loopback Adapter for the Beckhoff PLC.

1 Enter the AmsNetId according to the settings in TwinCAT.
- In our example this is 172.16.0.151.

2 In the «Select PLC» dialog choose «Beckhoff – TwinCAT TCP/IP».
- The dialog shown appears.

3 Set here the parameters for this communication.

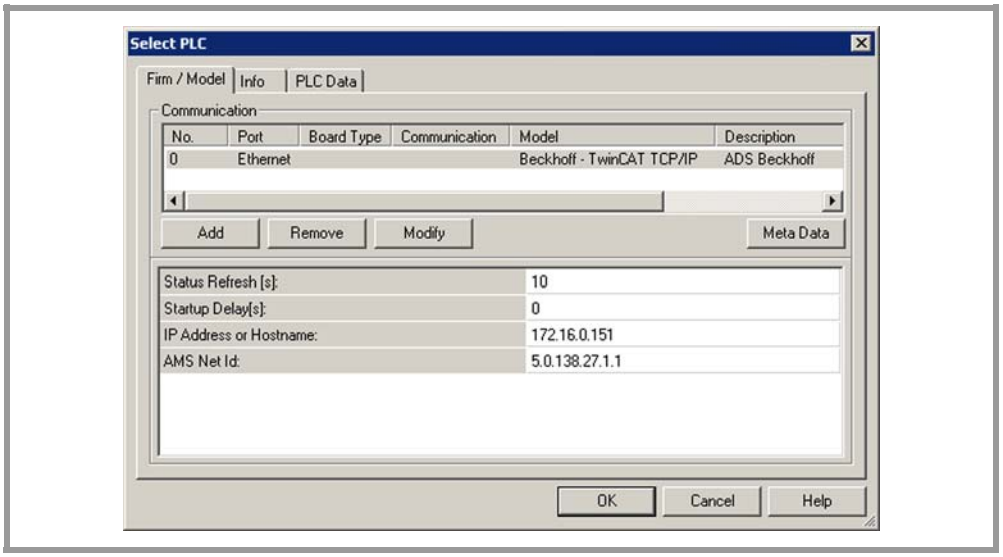

Fig. 17 Entering the AmsNetId

☞ The AmsNetId must only be used once. GALILEO always uses the AmsNetId consisting of the IP address with the suffix 1.1.

TwinCAT must not use this AmsNetId and must be reconfigured accordingly in all cases.

5.3 TwinCAT PLC Control and GRS on the same PC

If GRS and TwinCAT PLC Control are installed on the same PC, GRS must use its own IP address on the network adapter.

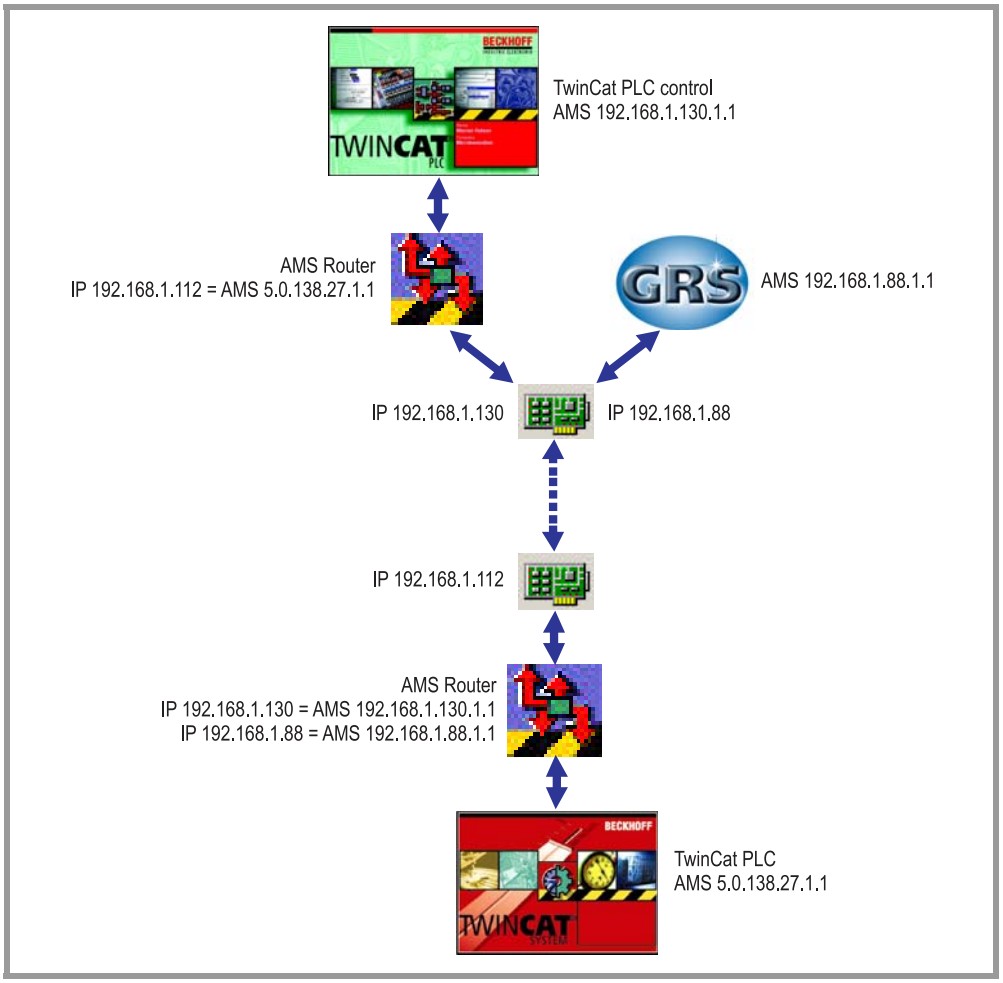

Fig. 18 IP addresses

5.3.1 Adding a second IP address to the network adapter

In the Control Panel find your network adapter in «Network Connections».

1 Add the new IP address for GRS to the «Internet Protocol (TCP/IP)».
- In our example this address is 192.168.1.88.

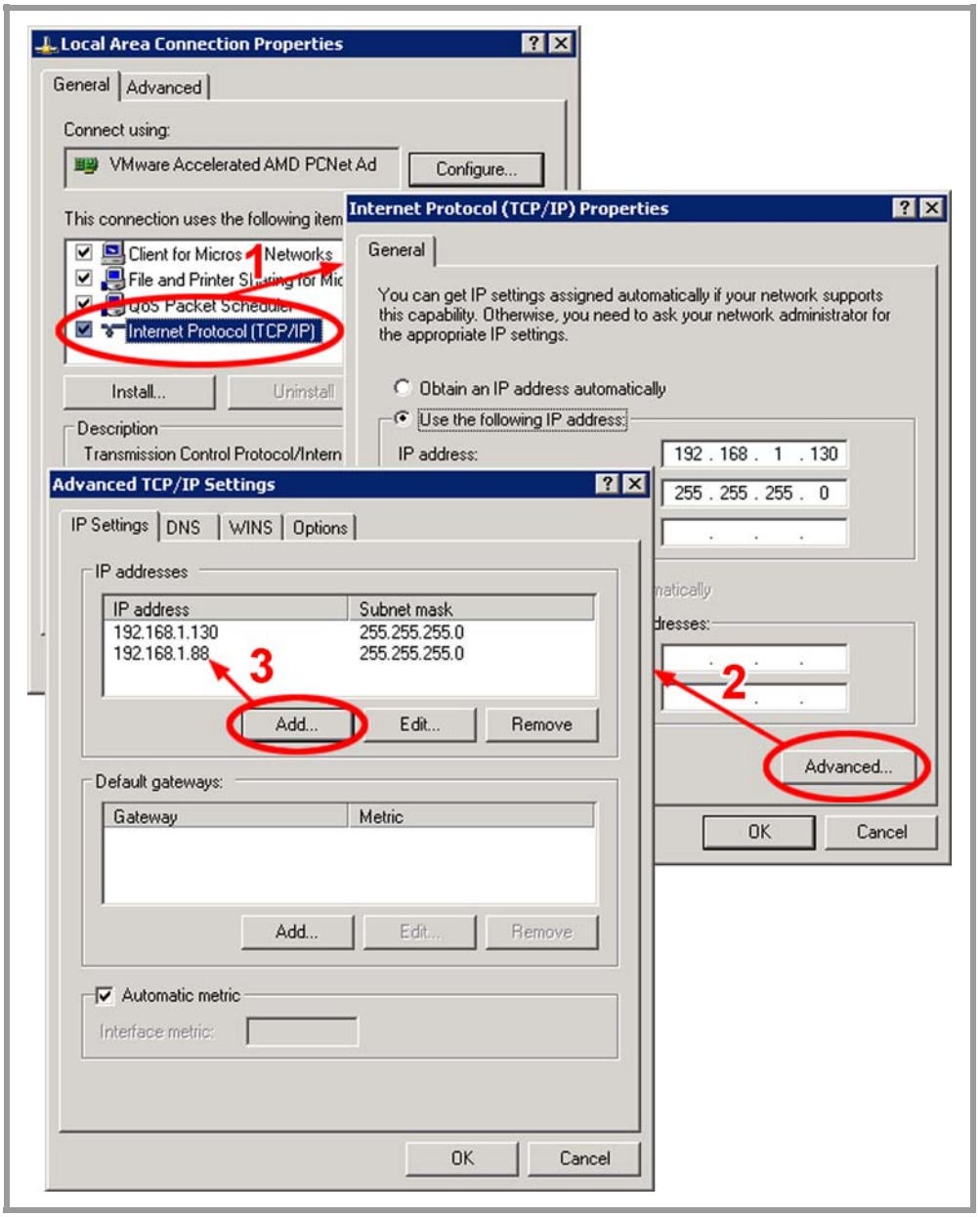

Fig. 19 Adding a second IP address

5.3.2 Assigning the second IP address to GRS

The order of IP addresses can be checked with «ipconfig».

```
C:\>ipconfig

Windows IP Configuration


Ethernet adapter LAN:

        Connection-specific DNS Suffix  . :
        IP Address. . . . . . . . . . . . : 192.168.1.130
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        IP Address. . . . . . . . . . . . : 192.168.1.88
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 192.168.1.13

C:\>
```

Fig. 20 ipconfig

GRS and TwinCAT PLC Control always use the first IP address of the network adapter. In order for GRS to use the second IP address, a «String3» entry must be present in the registry at the start of GRS.

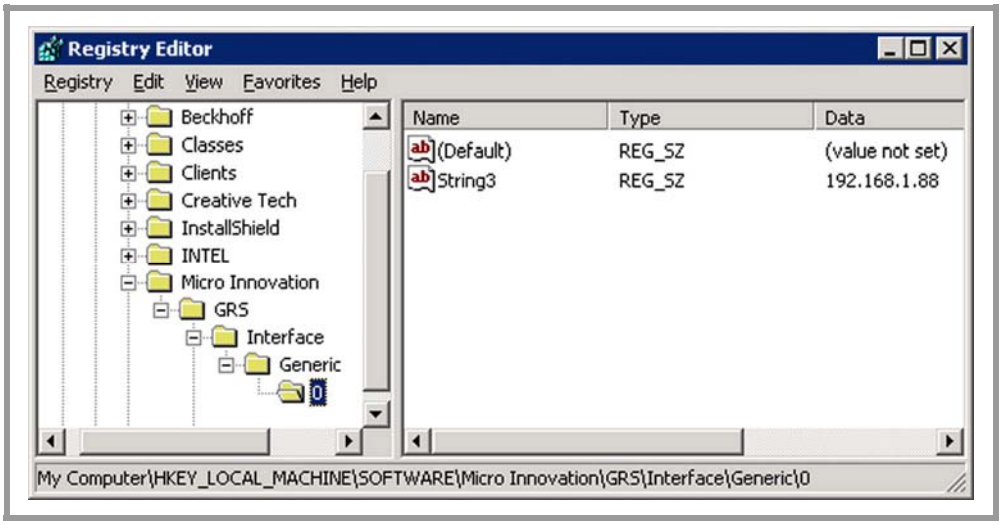

Fig. 21 Setting the second IP address via «String3»

This entry can be carried out manually with the Registry Editor or via the registry file (.reg). The registry file in our example must contain the following:

- Windows Registry Editor Version 5.00
- [HKEY_LOCAL_MACHINE\SOFTWARE\Micro Innovation\GRS\Interface\Generic\0]
- «String3»=«192.168.1.88»

5.3.3 Configuring the AMS router of the target system

1. Start «TcAmsRemoteMgr.exe» in the system directory of TwinCat.
2. Double-click the IP address of GRS.
3. Enter the AmsNetId for GRS.
   - GRS determines the AmsNetId by using the IP address and adding .1.1 to it.
4. Click [OK] twice.

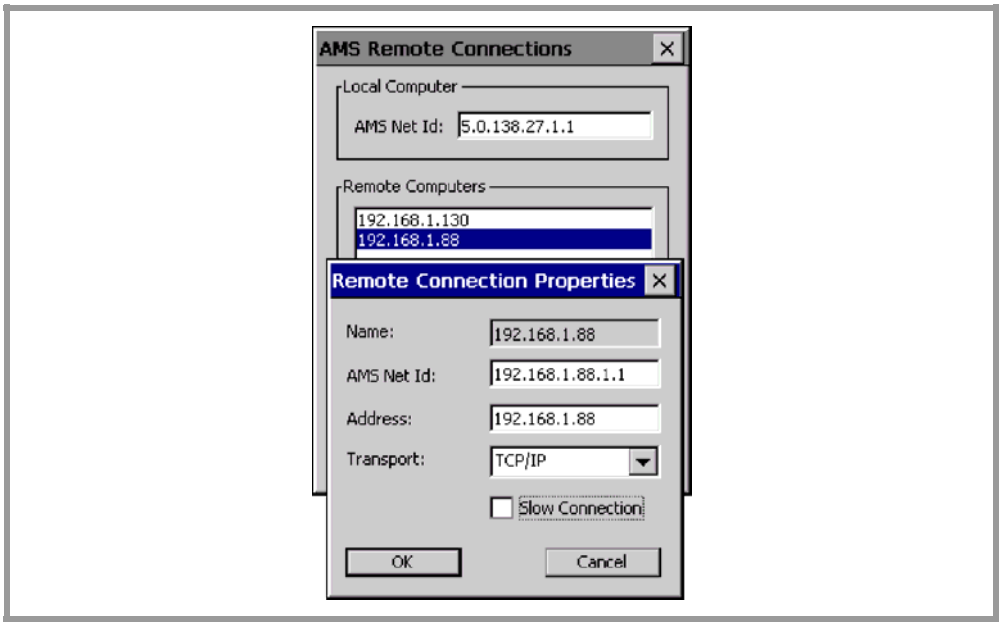

Fig. 22 Entering AmsNetId

5.3.4 Selecting the PLC in GALILEO

1 You must enter the IP address and the AmsNetId of the PLC in GALILEO like with a MICRO PANEL.

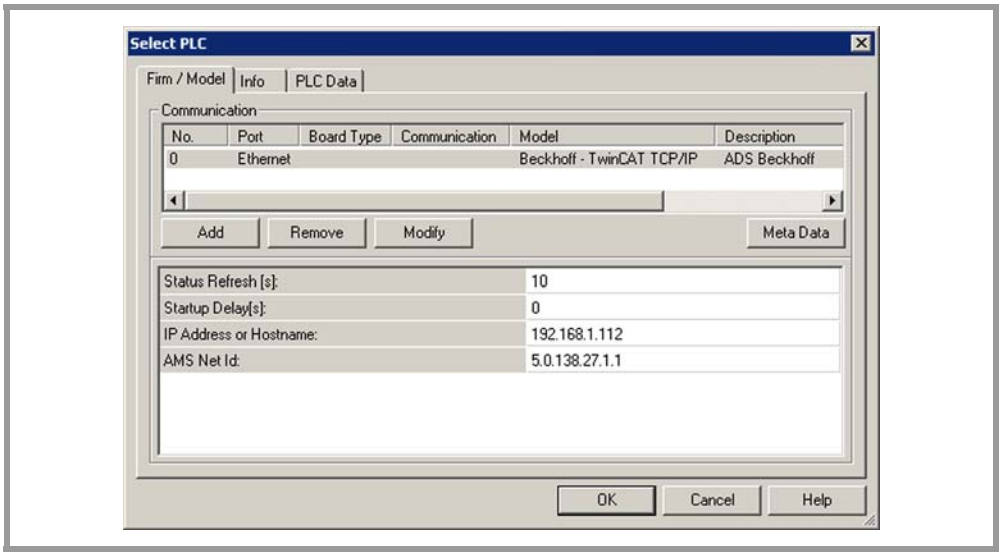

Fig. 23 Entering IP address and AmsNetId

6. Communication Errors

6.1 Error messages

Different system error messages are generated in response to any communication errors that occur. These system error messages provide different information:

- The «Tag variable name» indicates the tag variable in which a problem was found.
- The «IP Address, Protocol» indicates the interface and protocol of the MICRO PANEL at which the problem was found.
- The «Additional error information» may indicate the possible cause of an error in plain text. This information can, however, also be generated from lower software layers. Its content cannot therefore always be interpreted without an in-depth knowledge of the system. The troubleshooting procedure is the same in all cases. Refer to the relevant Beckhoff documentation for further information on ADS error messages.

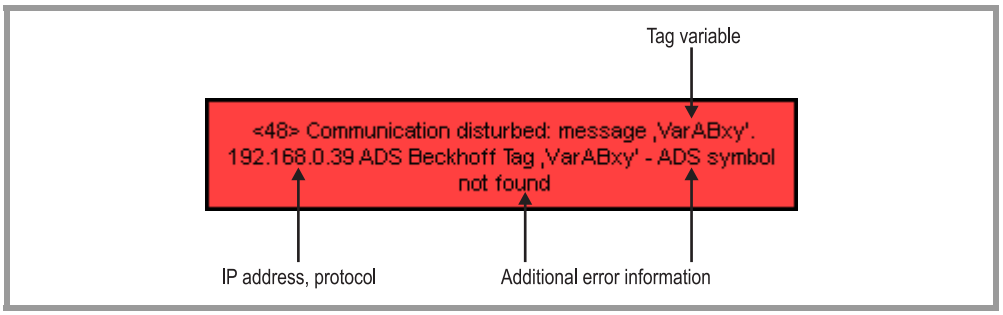

Fig. 24 Error message

6.2 Error rectification

1. Check the following points:
   - Cabling and the connections on the MICRO PANEL and the PLC.
   - Ethernet connection between the PLC and the MICRO PANEL by using PING.
   - Settings with the Beckhoff System Manager in the PLC.
   - All parameters in the GALILEO «Select PLC» dialog.
   - Whether the tag variable indicated in the system error message is present in the corresponding station.
   - Whether the Ethernet is overloaded.
2. Rectify the error.

If the problem continues, contact our Customer Support at support@microinnovation.com.